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# PATENT ABSTRACTS OF JAPAN

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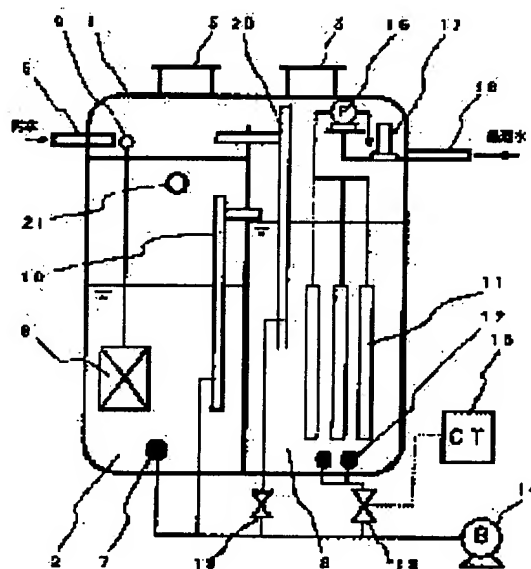
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## (54) METHOD FOR INTERMITTENTLY AERATING SEWAGE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To eliminate the need for the impeller and pump for agitation and to save agitation power when aerobic decomposition and anaerobic decomposition are repeated by allowing the anaerobic decomposition to consist of the suspension of aeration for a predetermined time and a repetition of the succeeding pulse aeration.

**SOLUTION:** Sewage is agitated by the air from a diffuser pipe 7, hence the solids are pulverized, and the sewage is pumped up by an air-lift pump 10 into an activated sludge chamber 3. A membrane filter 11 is dipped and arranged in the activated sludge liq. in the chamber 3 to filter the activated sludge liq. by the differential pressure produced by a suction pump 16. At this time, the activated sludge liq. is intermittently aerated according to the aeration schedule from a diffuser pipe 12, and the sewage is nitrated and denitrified. According to the schedule, the sewage is aerated (nitrated) by the air from the diffuser pipe 12 for a first fixed time, then the aeration is suspended for 5 to 20min, and the subsequent pulse aeration for  $\leq 2$ min is repeated several times (e.g. four).



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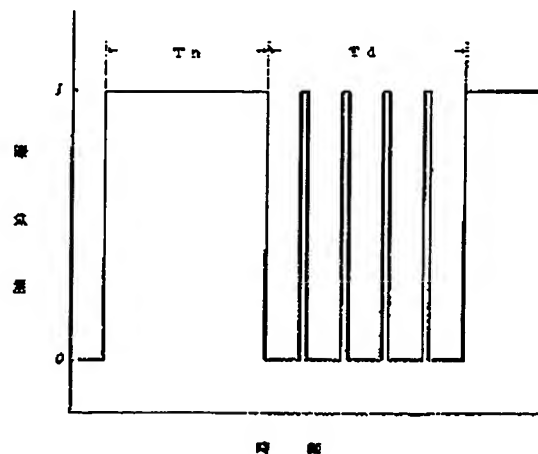
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(54) 【発明の名称】 汚水の間欠曝気処理方法

(57)【要約】

【課題】活性汚泥液を膜濾過しつつ汚水を浄化する間欠曝気処理の改良法であって、一定時間曝気をしない嫌氣的分解処理（脱窒処理）中の攪拌を攪拌羽根やポンプによらないでパルス曝気によって行うもので、攪拌動力を節約する方法を提供する。

【解決手段】活性汚泥の滞留する液中に浸漬して設けられた膜透過器とその膜透過器の下方に散気管が設けられた活性汚泥室へ、汚水を供給し、活性汚泥液を膜透過器で濾過しながら、散気管から一定時間曝気をする好氣的分解処理と一定時間曝気をしない嫌氣的分解処理の両処理を繰り返す汚水の間欠曝気処理方法において、前記嫌氣的分解処理は予め定められた時間の曝気停止とそれに続くパルス曝気を繰り返す。予め定められた時間の曝気停止は5～20分間、パルス曝気は2分を超えないあいだ曝気量0.05～5.0m<sup>3</sup>/m<sup>3</sup>/minで曝気することが好ましい。



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## 【特許請求の範囲】

【請求項1】 活性汚泥の滞留する液中に浸漬して設けられた膜濾過器とその膜濾過器の下方に散気管が設けられた活性汚泥室へ、汚水を供給し、活性汚泥液を膜濾過器で濾過しながら、散気管から一定時間曝気をする好氣的分解処理と一定時間曝気をしない嫌氣的分解処理の両処理を繰り返す汚水の間欠曝気処理方法であって、前記嫌氣的分解処理は予め定められた時間の曝気停止とそれに続くパルス曝気の繰返しからなることを特徴とする、汚水の処理方法。

【請求項2】 予め定められた時間の曝気停止が5～20分間の曝気停止であり、パルス曝気が2分を超えない間、曝気量0.05～5.0m<sup>3</sup>/m<sup>3</sup>/minで曝気するものである。請求項1の汚水の処理方法。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、家庭の便所・洗面所・風呂・厨房等から排出される汚水の間欠曝気処理方法に関する。

【0002】

【従来の技術】 家庭の便所・洗面所・風呂・厨房等から排出される汚水・排水を処理する家庭用浄化槽には、し尿単独処理浄化槽と、し尿及び雑排水の混合汚水を処理する合併排水処理浄化槽の2タイプがある。これらの浄化槽は、従来、維持管理が容易で、槽内汚泥濃度を高く保つことができ、浄化槽の大きさを比較的小型にできる固定床式がよく用いられている。この固定床式浄化槽の多くは、嫌気濾床室、好気活性汚泥室、沈殿室及び消毒室から成り、通常、沈殿室上澄水の一部は嫌気濾床室へ返送され処理されるので、循環式ともいわれる。上記固定床式の浄化槽では、嫌気濾床室に導入された汚水の有機物がそこで嫌気分解（メタン発酵等）を受ける。また、沈殿室から返送されてくる液中の硝酸イオンはそこで脱窒素される。次の好気活性汚泥室においては、有機物が酸化分解され、アンモニアは硝酸化される。そして、沈殿室で汚泥と上澄水が分離され、上澄水は嫌気濾床室へ返送される一部を除いて消毒室に送られ塩素等で滅菌処理されて放流される。

【0003】 近年、沈殿室を設けず、代わりに好気活性汚泥室内に膜分離器（膜モジュール）を浸漬・設置し、膜濾過液の一部を好気活性汚泥室へ返送する膜分離型浄化槽が、汚水が短時間に流入しても無処理汚水流出の危険が少なく、槽の小型化も期待できることから、検討されている（造水技術：第20巻、No.2、第65-68頁、1994年、特開昭61-120694号公報）。また、前記膜分離型浄化槽の簡略化・小型化や省エネルギーを目的として、嫌気濾床室及び好気活性汚泥室の2室の代わりに、膜濾過器を浸漬・設置した活性汚泥室1室のみにおいて、活性汚泥液を膜濾過しながら一定時間曝気をする

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氣的分解処理（脱窒処理）の両処理を繰返し、汚水を浄化する間欠曝気処理法も検討されている（辻隆正他：第29回日本環境学会年会講演集、第117-118頁、平成7年）。

【0004】

【発明が解決しようとする課題】 上記間欠曝気処理法において、一定時間曝気をしない嫌氣的分解処理（脱窒処理）中に、槽内の液を攪拌することは必要であり、従来は攪拌羽根やポンプによって行っている。本発明は、活性汚泥液を膜濾過しつつ汚水を浄化する間欠曝気処理の改良方法であって、一定時間曝気をしない嫌氣的分解処理（脱窒処理）中の攪拌を攪拌羽根やポンプによらずパルス曝気によって行うもので、攪拌動力を節約する方法を提供する。

【0005】

【課題を解決するための手段】 本発明は、下記の汚水の間欠曝気処理方法である。

（1） 活性汚泥の滞留する液中に浸漬して設けられた膜濾過器とその膜濾過器の下方に散気管が設けられた活性汚泥室へ、汚水を供給し、活性汚泥液を膜濾過器で濾過しながら、散気管から一定時間曝気をする好氣的分解処理と一定時間曝気をしない嫌氣的分解処理の両処理を繰り返す汚水の間欠曝気処理方法であって、前記嫌氣的分解処理は予め定められた時間の曝気停止とそれに続くパルス曝気の繰返しからなることを特徴とする、汚水の処理方法。

（2） 予め定められた時間の曝気停止が5～20分間の曝気停止であり、パルス曝気が2分を超えない間、曝気量0.05～5.0m<sup>3</sup>/m<sup>3</sup>/minで曝気するものである。上記（1）の処理方法。

【0006】 本発明を図により説明すれば、図1の「曝気のタイムスケジュール」（横軸は時間、縦軸は曝気量（任意単位））に示されるようになる。図1中、T<sub>n</sub>は硝化処理の時間、T<sub>d</sub>は脱窒処理の時間であり、T<sub>d</sub>中に一定の頻度でパルス曝気する。

【0007】 本発明において、パルス曝気の強さ、時間及び頻度（又は、曝気停止の時間）は、活性汚泥液の静止時の膜濾過ケーキの成長速度と酸素移動速度、並びに活性汚泥液の濃度と濾過速度の値から総合的に判断して設定することができる。濃度1万ppm程度の活性汚泥液は、5～20分間では顕著な汚泥沈降はみられない。また、活性汚泥室内への汚水の流入は活性汚泥液を適度に攪拌する。そのため、パルス曝気は活性汚泥液にゆるやかな回転流が起こる程度でよい。槽の大きさ等によっても変動するが、槽の大きさが1～3m<sup>3</sup>であればパルス曝気の曝気量は0.05～5.0m<sup>3</sup>/m<sup>3</sup>/min、好ましくは0.2～2.0m<sup>3</sup>/m<sup>3</sup>/minであり、パルス曝気の時間は2分以内、好ましくは30～60秒である。パルス曝気の曝気量が5.0m<sup>3</sup>/m<sup>3</sup>/minと

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と、Tdにおける曝気条件の維持が困難となり脱窒が不完全となりやすい。また、パルス曝気の曝気量が $0.05\text{ m}^3/\text{m}^3/\text{min}$ 未満の場合は、汚泥の攪拌不足になりやすい。なお、曝気量の単位 $\text{m}^3/\text{m}^3/\text{min}$ は、曝気量容置/槽内の液容量/分の意味で、例えば、 $2.0\text{ m}^3$ の曝気槽に $1.0\text{ m}^3$ の活性汚泥液が存在する状態で毎分 $1.0\text{ m}^3$ の空気を曝気すると、曝気量は $1.0\text{ m}^3/\text{m}^3/\text{min}$ である。また、Tdにおけるパルス曝気の周期、すなわち、一つのパルスと次のパルスの間の長さ(時間)は、通常、 $5\sim 20$ 分、好ましくは $10\sim 15$ 分である。5分未満では、Tdにおける曝気条件の維持が困難となり脱窒が不完全となりやすく、20分を超えると反応を進めるための汚泥攪拌が不足になりやすい。

【0008】散気管から一定時間曝気をする好氣的分解処理と、それに続く一定時間曝気をしない嫌氣的分解処理の両処理の1サイクルの時間(すなわち、 $T_n+T_d$ )は、浄化槽の運転条件に応じて適宜、最適時間を決定すればよいが、通常は $1\sim 4$ 時間である。また $T_n$ と $T_d$ の時間比率も、浄化槽の運転条件に応じて適宜、最適比率を決定すればよいが、通常は、 $1:3$ から $1:1$ の範囲であり、脱窒効果を上げるためには $T_n$ よりも $T_d$ の方を長めに設定する。

【0009】以上の設定条件の変動幅を考慮すると、「 $T_n+T_d$ 」1サイクルの $T_d$ における「予め定められた時間の曝気停止とそれに続くパルス曝気」の繰返し回数は、通常、 $2\sim 18$ 回である。

【0010】活性汚泥室を曝気する好氣的分解処理の間( $T_n$ )は、活性汚泥室内の散気管からの曝気は連続的に行い、膜濾過器に通じている吸引ポンプも連続的に稼働させ、濾過する。この曝気処理により汚水中の有機物は好氣的に酸化され、窒素化合物は硝酸イオンにまで酸化される。

【0011】活性汚泥室を曝気しない嫌氣的分解処理の間( $T_d$ )は、活性汚泥液は曝気状態もしくは準曝気状態に保たれる。この間のパルス曝気は反応液の攪拌を目的とするために行うのである。

【0012】本発明において、活性汚泥液中に浸漬して用いる膜濾過器は、精密濾過が可能な膜濾過型固液分離器のことであり、精密濾過能のある有機高分子膜とそれを支持する支持体、集水部等からなる膜濾過器、精密濾過能のある金属フィルタ又はセラミックフィルタを組み込んだ膜濾過器等も使用できる。膜濾過器の形状は、平板状、管状等の種々のものを用いることができるが、平板状(平膜モジュール)が好ましく用いられる。濾過膜面の内側と外側は濾過推進力を生じさせるために吸引ポンプで濾過膜内側を吸引したり、水頭差を生じさせるために濾過液取り出し口を活性汚泥室の液面より下方に設置したりする。また、膜濾過器は膜濾過面が鉛直となる

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気による液上昇流により、膜濾過器の膜面に堆積した固形物を強制的に排除するためである。平板状膜(平膜モジュール)を用いる場合は、通常、複数枚を設置する。

【0013】なお、上記における金属フィルタは、ステンレス鋼等の金属を圧延して細かな網目基板とし、これにステンレス粉末、酸化ニッケル、酸化銅等の微粉末を含む懸濁液又はペーストを塗布し焼結する方法、ステンレス粉末等の第1の金属粉末を焼結させて穿孔径の比較的大きな第1のフィルタ層を形成させ、これにステンレス粉末、酸化ニッケル、酸化銅等の微粉末を含む懸濁液又はペーストを塗布し焼結する方法等により、製造することができる。

【0014】活性汚泥室には、膜濾過器の下方でかつ活性汚泥室の底部近くに、ブロー等からの空気を活性汚泥室に吹き込む散気管が設けられる。この散気管からの曝気は、酸素供給と汚泥液の攪拌目的のほか、膜濾過器の濾過膜面に堆積する固形物を強制的に排除する役目もある。膜濾過器を通過した膜濾過液(清澄液)は、最後に塩素等で滅菌処理され放流される。

【0015】

【発明の実施の形態】本発明の汚水の間欠曝気処理方法を図に基づき説明する。図1は曝気のタイムスケジュール、図2は本発明の間欠曝気処理方法を実施できる一例の浄化槽の正面模式図、図3はその平面模式図である。浄化槽1の本体は、通常、FRPやSMC等で造られる。浄化槽1は汚水の流れに沿って大きく、流量調整室2、活性汚泥室3、及び汚泥貯留4に分割されている。また、点検整備時の便宜のため浄化槽にはマンホール蓋5が設けられている。

【0016】汚水は、汚水流入管6から流量調整室2に流入する。汚水にはトイレトペーパー等の固形物が含まれるので、そのままではエアリフトポンプ10で搬送できない。そこで流量調整室2に一旦貯留し、ブロー14により供給される空気を散気管7から曝気しながら攪拌し、固形物を小さく砕く。流量調整室2の水位は、エアリフトポンプ10が汚水を汲み上げることでない最低水位と、汚水の最大流入量から予測される最高水位の間にある。流量調整室2の最低水位の下に、網状プラスチック濾床8と、散気管7が設置され、汚水中の固形物を常時砕き分散させると共に、毛髪類・プラスチック類等の破砕困難な固形物は網状プラスチック濾床8で捕捉される。これにより、エアリフトポンプ10の詰まりを防止し、次の活性汚泥室3に設置された膜濾過器11の膜面閉塞又は膜破損を防止する。

【0017】エアリフトポンプ10で汲み上げられた汚水は、活性汚泥室3に流入する。活性汚泥室3には、膜濾過器11が活性汚泥液内に浸漬・配置され、膜濾過器11の下方には、散気管12が設置されている。膜濾過器11の膜面の内側は吸引ポンプ16に通じていて、そ

方向に置く。隣通器の下方に設置した散気管からの曝 50 の吸引ポンプにより生じる差圧によって活性汚泥液が適



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過される。膜を通過した活性汚泥中の液（濾過液）は減菌器17に接触後、処理済み水として放流管18から排出される。

【0018】散気管12からの曝気は、図1で示されるような曝気スケジュールによって間欠的に曝気され、活性汚泥室3内で汚水の硝化処理及び脱窒処理の両処理が行われる。散気管12には電磁弁、空気作動弁等の制御弁13が設けられ、制御弁13の開閉は作動シーケンスをプログラムした制御タイマー15で制御されている。そして、膜濾過器11の膜面表面は、散気管12からの曝気による活性汚泥液の上昇流により汚泥ケーキの堆積が防止される。

【0019】図1の曝気スケジュールでは、初めの一定時間は散気管12から曝気（硝化処理）され、その後、5～20分の間の曝気停止とそれに続く2分以内のパルス曝気が複数回（図1では4回）、繰り返される（脱窒処理）。以下、曝気スケジュールに従って硝化処理及び脱窒処理が繰り返される。なお、曝気停止中も吸引ポンプ16は稼働させたままにしておく。

【0020】定期保守点検時に、活性汚泥室3の汚泥濃度をチェックした上、空気弁19を開け、エアリフトポンプ20を作動させ、活性汚泥室3内の分解処理困難な汚泥（余剰汚泥）を汚泥貯留室4に搬送する。その際、汚泥貯留室4の液面が越流口21を越える場合、汚泥貯留室4の上澄が流量調整室2へオーバーフローし、原水（汚水）と混ざり、以下、原水と同じ経路で処理される。

\*【0021】

【発明の効果】本発明は膜濾過を用いる汚水の間欠曝気処理法であって、一定時間曝気をしない嫌氣的分解処理（脱窒処理）時の攪拌を攪拌羽根やポンプによらないでパルス曝気によって行うもので、攪拌動力を節約（省エネルギー）できると共に汚水を高度に処理できる。

【図面の簡単な説明】

【図1】本発明の間欠曝気処理方法における曝気のタイムスケジュールを表すグラフである。

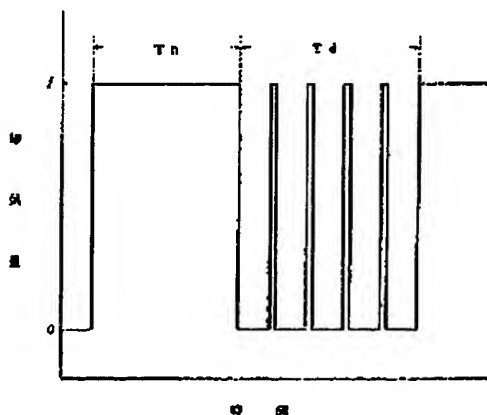
【図2】本発明の間欠曝気処理方法を実施できる浄化槽の正面模式図である。

【図3】図2の浄化槽の平面模式図である。

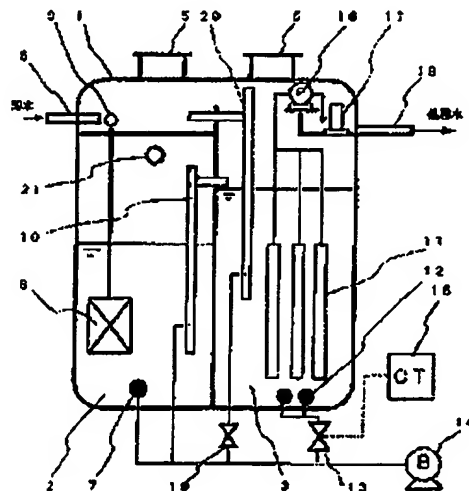
【符号の説明】

- |           |              |
|-----------|--------------|
| 1…浄化槽本体   | 2…流量調整室      |
| 3…好気活性汚泥室 | 4…汚泥貯留室      |
| 5…マンホール蓋  | 6…流入管        |
| 7…散気管     | 8…網状プラスチック濾床 |
| 9…濾床取っ手   | 10…エアリフトポンプ  |
| 11…膜濾過器   | 12…散気管       |
| 13…制御弁    | 14…空気ブローア    |
| 15…制御タイマー | 16…吸引ポンプ     |
| 17…減菌器    | 18…放流管       |
| 19…空気弁    | 20…エアリフトポンプ  |
| 21…越流口    |              |

【図1】



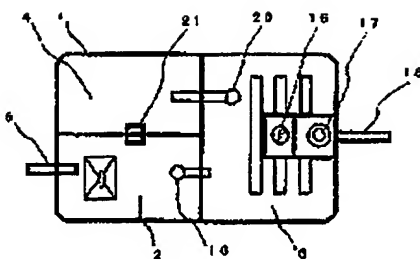
【図2】



(5)

特開平9-192688

【図3】



**JAPANESE** [JP,09-192688,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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**CLAIMS**

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[Claim(s)]

[Claim 1] Supplying the sanitary sewage to the active sludge room in which the powder trachea was prepared under the membrane filtration machine immersed and formed into the liquid with which active sludge piles up, and its membrane filtration machine, and filtering active sludge liquid with a membrane filtration vessel It is the intermittent aeration art of the sanitary sewage which does not carry out aerobic digestion processing which carries out fixed time amount aeration from a powder trachea, and fixed time amount aeration and which repeats both processings of aversion decomposition processing. the loop deer of an aeration halt of the time amount as which said aversion-decomposition processing was determined beforehand, and the pulse aeration following it -- the art of the sanitary sewage characterized by things.

[Claim 2] The art of the sanitary sewage of claim 1 which an aeration halt of the time amount defined beforehand is an aeration halt for 5 - 20 minutes, and is what carries out aeration by amount of aeration of 0.05-5.0m<sup>3</sup>/m<sup>3</sup>/min while pulse aeration does not exceed 2 minutes.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the intermittent aeration art of the sanitary sewage discharged from domestic rest room, washroom, bath, kitchen, etc.

[0002]

[Description of the Prior Art] There are two types of a nightsoil independent processing septic tank and the union waste-water-treatment septic tank which processes nightsoil and the mixed sanitary sewage of a waste of the home septic tanks which process the sanitary sewage and wastewater discharged from domestic rest room, washroom, bath, kitchen, etc. Conventionally, these septic tanks are easy a maintenance, and can keep the sludge concentration in a tub high, and the fixed-bed type which can make magnitude of a septic tank comparatively small is used well. Many of these fixed-bed type septic tanks consist of an aversion filter bed room, an aerobic active sludge room, a sedimentation compartment, and a sterilizing room, and since some sedimentation compartment supernatant water is returned to an aversion filter bed room and it is processed, it is also usually called a circuit system. By the above-mentioned fixed-bed-type septic tank, the organic substance of the sanitary sewage introduced into the aversion filter bed room receives aversion decomposition (methane fermentation etc.) there. Moreover, denitrification of the nitrate ion in the liquid returned from a sedimentation compartment is carried out there. At the next aerobic active sludge room, oxidative degradation of the organic substance is carried out, and ammonia is nitric-acid-ized. And sludge and supernatant water are separated in a sedimentation compartment, supernatant water is sent to a sterilizing room except for the part returned to an aversion filter bed room, and with chlorine etc., sterilization processing is carried out and it is discharged.

[0003] Even if the sanitary sewage flows [ the membrane-separation mold septic tank which does not prepare a sedimentation compartment, but immerses for it and installs a membrane-separation machine (membrane module) instead in the aerobic active sludge interior of a room, and returns some membrane filtration liquid to an aerobic active sludge room ] for a short time in recent years, the risk of a non-processed sanitary-sewage outflow is examined from it being few and the miniaturization of a tub being expected (fresh-water-generation technique: the 20th volume, No.2, the 65 - 68th page, 1994, JP,61-120694,A). Moreover, it sets instead of two rooms, an aversion filter bed room and an aerobic active sludge room, only in the active sludge room 1 room which immersed for it and installed the membrane filtration machine for the purpose of simplification and a miniaturization, and energy saving of said membrane-separation mold septic tank. Both processings of the aversion-decomposition processing (denitrification processing) which does not carry out aerobic digestion processing (nitrification processing) which carries out fixed time amount aeration while carrying out membrane filtration of the active sludge liquid, and fixed time amount aeration are repeated. The intermittent aeration approach which purifies the sanitary sewage is also examined (others [ Takamasa / crossing ]: the 29th JAPAN ASSOCIATION ON THE ENVIRONMENTAL STUDIES annual convention lecture collection, the 117 - 118th page, Heisei 7).

[0004]

[Problem(s) to be Solved by the Invention] In the above-mentioned intermittent aeration approach, it is required to agitate the liquid in a tub during the aversion-decomposition processing (denitrification processing) which does not carry out fixed time amount aeration, and it is conventionally based on the impeller or the pump. Pulse aeration performs this invention without depending churning under aversion-decomposition processing (denitrification processing) which is a method of improving the intermittent aeration processing which purifies the sanitary sewage, and does not carry out fixed time amount aeration on an impeller or a pump, carrying out membrane filtration of the active sludge liquid, and the approach of saving the power requirement for agitation and mixing is offered.

[0005]

[Means for Solving the Problem] This invention is the intermittent aeration art of the following sanitary sewage. (1), supplying the sanitary sewage to the active sludge room in which the powder trachea was prepared under the membrane filtration machine immersed and formed into the liquid with which active sludge piles up, and its membrane filtration machine, and filtering active sludge liquid with a membrane filtration vessel. It is the intermittent aeration art of the sanitary sewage which does not carry out aerobic digestion processing which carries out fixed time amount aeration from a powder trachea, and fixed time amount aeration and which repeats both processings of aversion decomposition processing. the loop deer of an aeration halt of the time amount as which said aversion-decomposition processing was determined beforehand, and the pulse aeration following it -- the art of the sanitary sewage characterized by things.

(2) The art of the above (1) which an aeration halt of the time amount defined beforehand is an aeration halt for 5 - 20 minutes, and is what carries out aeration by amount of aeration of 0.05-5.0m<sup>3</sup>/m<sup>3</sup>/min while pulse aeration does not exceed 2 minutes.

[0006] If drawing explains this invention, it comes to be shown in "the time schedule of aeration" (an axis of abscissa is the time amount and an axis of ordinate is the amount of aeration (arbitration unit)) of drawing 1. Among drawing 1, T<sub>n</sub> is the time amount of denitrification processing and carries out pulse aeration of the time amount of nitrification processing, and the T<sub>d</sub> by fixed frequency into T<sub>d</sub>.

[0007] In this invention, time amount and frequency (or time amount of an aeration halt) can be synthetically judged from the value of the concentration and the filtration velocity of active sludge liquid in the strength of pulse aeration in the growth rate of the membrane filtration cake at the time of quiescence of active sludge liquid, oxygen transfer rate, and a list, and it can set up. Sludge sedimentation with active sludge liquid with a concentration of about 10,000 ppm remarkable in 5 - 20 minutes is not seen. Moreover, the inflow of the sanitary sewage to the active sludge interior of a room agitates active sludge liquid moderately. Therefore, pulse aeration is good for active sludge liquid at extent to which loose rotating flow happens. although changed with the magnitude of a tub etc., if the magnitude of a tub is one to 3 m<sup>3</sup> -- the amount of aeration of pulse aeration -- 0.05-5.0m<sup>3</sup>/m<sup>3</sup>/min -- it is 0.2-2.0m<sup>3</sup>/m<sup>3</sup>/min preferably, and the time amount of pulse aeration is 30 - 60 seconds preferably less than 2 minutes. If the amount of aeration of pulse aeration is larger than 5.0m<sup>3</sup>/m<sup>3</sup>/min or the time amount of pulse aeration exceeds 2 minutes, maintenance of the anaerobic condition in T<sub>d</sub> will become difficult, and denitrification will tend to become imperfect. Moreover, when the amounts of aeration of pulse aeration are under 0.05m<sup>3</sup>/m<sup>3</sup>/min, it is easy to become the lack of churning of sludge. In addition, m<sup>3</sup> of the unit of the amount of aeration/m<sup>3</sup>/min is the semantics for liquid capacity/in the amount capacity of aeration / tub, for example, when aeration of the air of 3 is carried out per minute 1.0m in the condition that 1.0m of active sludge liquid of 3 exists in the aerator of 3 2.0m, the amount of aeration is 1.0m<sup>3</sup>/m<sup>3</sup>/min. Moreover, the period of the pulse aeration in T<sub>d</sub>, i.e., the die length between one pulse and the following pulse, (time amount) is usually 10 - 15 minutes preferably for 5 to 20 minutes. In less than 5 minutes, maintenance of the anaerobic condition in T<sub>d</sub> becomes difficult, denitrification tends to become imperfect, and if it exceeds 20 minutes, sludge churning for advancing a reaction will tend to become insufficient.

[0008] Although the time amount of 1 cycle of the aerobic digestion processing which carries out fixed time amount aeration from a powder trachea, and both processings of the aversion-decomposition processing which does not carry out fixed time amount aeration following it (namely, T<sub>n</sub>+T<sub>d</sub>) should just decide on the optimal time amount suitably according to the service condition of a septic tank, it is usually 1 - 4 hours. Moreover,

although the time amount ratio of  $T_n$  and  $T_d$  should just also determine the rate of optimum ratio suitably according to the service condition of a septic tank, it is the range of 1:3 to 1:1, and in order to raise the denitrification effectiveness, it usually sets up the  $T_d$  for a long time rather than  $T_n$ .

[0009] When the range of fluctuation of the above setups is taken into consideration, the count of a repetition of "an aeration halt of the time amount defined beforehand and the pulse aeration following it" in  $T_d$  of " $T_n+T_d$ " 1 cycle is usually 2 - 18 times.

[0010] During the aerobic digestion processing which carries out aeration of the active sludge room, ( $T_n$ ) is performed continuously, also works continuously the suction pump which leads to the membrane filtration machine, and filters the aeration from the powder trachea of the active sludge interior of a room. The organic substance in the sanitary sewage oxidizes aerobically by this aeration processing, and a nitride oxidizes even to nitrate ion.

[0011] Active sludge liquid is maintained at an anaerobic condition or a semi- anaerobic condition for ( $T_d$ ) during the aversion-decomposition processing which does not carry out aeration of the active sludge room. Pulse aeration in the meantime is performed in order to aim at churning of reaction mixture.

[0012] The membrane filtration machine immersed and used into active sludge liquid in this invention is a membrane filtration mold solid-liquid-separation machine in which precision filtration is possible, and the membrane filtration machine incorporating a metal filter or a ceramic filter with the membrane filtration machine which consists of a base material which supports an organic poly membrane with precision filtration ability and it, the catchment section, etc., and precision filtration ability etc. can be used for it. Although the various things of plate-like and tubular \*\* can be used for the configuration of a membrane filtration machine, plate-like (flat film module) is used preferably. Since the inside and the outside of a filtration membrane side produce filtration driving force, they attract the filtration membrane inside with a suction pump, or since a water head difference is produced, they install filtrate output port caudad from the oil level of an active sludge room. Moreover, a membrane filtration machine is placed in the direction in which a membrane filtration side becomes perpendicular. It is for eliminating compulsorily the solid deposited on the film surface of a membrane filtration machine according to the liquid upward flow by the aeration from the powder trachea installed under the membrane filtration machine. When using the plate-like film (flat film module), two or more sheets are usually installed.

[0013] In addition, the metal filter in the above rolls out wire gauzes, such as stainless steel, and uses them as a fine mesh substrate. How to apply and sinter the suspension or the paste which contains impalpable powder, such as stainless steel powder, nickel oxide, and copper oxide, in this, The 1st metal powder, such as stainless steel powder, can be made to be able to sinter, the 1st comparatively big filter layer of the diameter of a hole can be made to be able to form, and it can manufacture by the approach of applying and sintering the suspension or the paste which contains impalpable powder, such as stainless steel powder, nickel oxide, and copper oxide, in this etc.

[0014] The powder trachea which is the lower part of a membrane filtration machine, and blows the air from Blois etc. into an active sludge room near the pars basilaris ossis occipitalis of an active sludge room is prepared in an active sludge room. The aeration from this powder trachea also has the duty which eliminates compulsorily the solid deposited on the filtration membrane side of a membrane filtration machine other than the churning purpose of oxygen supply and sludge liquid. With chlorine etc., sterilization processing is carried out and the membrane filtration liquid (founding liquid) which passed the membrane filtration machine is discharged to the last.

[0015]

[Embodiment of the Invention] The intermittent aeration art of the sanitary sewage of this invention is explained based on drawing. The transverse-plane mimetic diagram of the septic tank of an example in which drawing 1 can enforce the time schedule of aeration and drawing 2 can enforce the intermittent aeration art of this invention, and drawing 3 are the mimetic diagram. The body of a septic tank 1 is usually built in FRP, SMC, etc. In accordance with the flow of the sanitary sewage, a septic tank 1 is large and is divided into the flow control room 2, the active sludge room 3, and the sludge reservoir 4. Moreover, the manhole lid 5 is formed in

the septic tank for the facilities at the time of inspection and repair.

[0016] The sanitary sewage flows into the flow control room 2 from the sanitary-sewage inhalant canal 6. Since solids, such as toilet paper, are contained in the sanitary sewage, if it remains as it is, it cannot convey with an air lift pump 10. Then, it once stores in the flow control room 2, and it agitates, carrying out aeration of the air supplied by Blois 14 from the powder trachea 7, and a solid is broken small. The water level of the flow control room 2 has an air lift pump 10 between the lowest water level which cannot pump up the sanitary sewage, and the highest high water level predicted from the amount of maximum flow ON of the sanitary sewage. In the bottom of the lowest water level of the flow control room 2, the reticulated plastics filter bed 8 and the powder trachea 7 are installed, and while always breaking the solid in the sanitary sewage and making it distribute, the solid with difficult crushing of hair and plastics is caught in the reticulated plastics filter bed 8. Thereby, plugging of an air lift pump 10 is prevented and film surface lock out or film breakage of the membrane filtration machine 11 installed in the next active sludge room 3 is prevented.

[0017] The sanitary sewage pumped up with the air lift pump 10 flows into the active sludge room 3. The membrane filtration machine 11 is immersed and arranged in active sludge liquid, and the powder trachea 12 is installed in the active sludge room 3 under the membrane filtration machine 11. The inside of the film surface of the membrane filtration machine 11 leads to the suction pump 16, and active sludge liquid is filtered by the differential pressure produced with the suction pump. The liquid in the active sludge which passed the film (filtrate) is discharged from an effluent pipe 18 as processed water after contacting a sterilizer 17.

[0018] Aeration of the aeration from the powder trachea 12 is intermittently carried out by the aeration schedule as shown by drawing 1, and nitrification processing of the sanitary sewage and both processings of denitrification processing are performed in the active sludge room 3. The control valves 13, such as a solenoid valve and a pressure-controlled valve, are formed in the powder trachea 12, and closing motion of a control valve 13 is controlled by the controlling timer 15 which programmed actuation sequence. And deposition of a sludge cake is prevented according to the upward flow of active sludge liquid according [ the film surface front face of the membrane filtration machine 11 ] to the aeration from the powder trachea 12.

[0019] the pulse aeration for less than 2 minutes which aeration (nitrification processing) of the first fixed time amount is carried out from the powder trachea 12 to the aeration schedule of drawing 1, and follows an aeration halt for after that and 5 - 20 minutes, and it -- multiple times ( drawing 1 4 times ) -- it is repeated (denitrification processing). Hereafter, nitrification processing and denitrification processing are repeated according to an aeration schedule. In addition, it keeps [ work / during an aeration halt / a suction pump 16 ] made.

[0020] At the time of periodic maintenance check, after checking the sludge concentration of the active sludge room 3, an air valve 19 is opened, the air lift pump 20 is operated, and sludge (excess sludge) with the difficult decomposition processing in the active sludge room 3 is conveyed in the sludge reservoir room 4. When the oil level of the sludge reservoir room 4 exceeds the overflow opening 21 in that case, the supernatant of the sludge reservoir room 4 overflows to the flow control room 2, is mixed with raw water (sanitary sewage), and is hereafter processed in the same path as raw water.

[0021]

[Effect of the Invention] It is the intermittent aeration approach of the sanitary sewage which uses membrane filtration, this invention carries out by pulse aeration without depending churning at the time of the aversion-decomposition processing (denitrification processing) which does not carry out fixed time amount aeration on an impeller or a pump, and it can process the sanitary sewage to altitude while it can save the power requirement for agitation and mixing (energy saving).

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**TECHNICAL FIELD**

---

[Field of the Invention] This invention relates to the intermittent aeration art of the sanitary sewage discharged from domestic rest room, washroom, bath, kitchen, etc.

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## PRIOR ART

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[Description of the Prior Art] There are two types of a nightsoil independent processing septic tank and the union waste-water-treatment septic tank which processes nightsoil and the mixed sanitary sewage of a waste of the home septic tanks which process the sanitary sewage and wastewater discharged from domestic rest room, washroom, bath, kitchen, etc. Conventionally, these septic tanks are easy a maintenance, and can keep the sludge concentration in a tub high, and the fixed-bed type which can make magnitude of a septic tank comparatively small is used well. Many of these fixed-bed type septic tanks consist of an aversion filter bed room, an aerobic active sludge room, a sedimentation compartment, and a sterilizing room, and since some sedimentation compartment supernatant water is returned to an aversion filter bed room and it is processed, it is also usually called a circuit system. By the above-mentioned fixed-bed-type septic tank, the organic substance of the sanitary sewage introduced into the aversion filter bed room receives aversion decomposition (methane fermentation etc.) there. Moreover, denitrification of the nitrate ion in the liquid returned from a sedimentation compartment is carried out there. At the next aerobic active sludge room, oxidative degradation of the organic substance is carried out, and ammonia is nitric-acid-ized. And sludge and supernatant water are separated in a sedimentation compartment, supernatant water is sent to a sterilizing room except for the part returned to an aversion filter bed room, and with chlorine etc., sterilization processing is carried out and it is discharged.

[0003] Even if the sanitary sewage flows [ the membrane-separation mold septic tank which does not prepare a sedimentation compartment, but immerses for it and installs a membrane-separation machine (membrane module) instead in the aerobic active sludge interior of a room, and returns some membrane filtration liquid to an aerobic active sludge room ] for a short time in recent years, the risk of a non-processed sanitary-sewage outflow is examined from it being few and the miniaturization of a tub being expected (fresh-water-generation technique: the 20th volume, No.2, the 65 - 68th page, 1994, JP,61-120694,A). Moreover, it sets instead of two rooms, an aversion filter bed room and an aerobic active sludge room, only in the active sludge room 1 room which immersed for it and installed the membrane filtration machine for the purpose of simplification and a miniaturization, and energy saving of said membrane-separation mold septic tank, The intermittent [ which does not carry out aerobic digestion processing (nitrification processing) which carries out fixed time amount aeration, and fixed time amount aeration ] aeration approach which repeats both processings of aversion decomposition processing (denitrification processing), and purifies the sanitary sewage is also examined, carrying out membrane filtration of the active sludge liquid (others [ Takamasa / crossing ]: the 29th JAPAN ASSOCIATION ON THE ENVIRONMENTAL STUDIES annual convention lecture collection, the 117 - 118th page, Heisei 7).

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**EFFECT OF THE INVENTION**

---

[Effect of the Invention] It is the intermittent aeration approach of the sanitary sewage which uses membrane filtration, this invention carries out by pulse aeration without depending churning at the time of the aversion-decomposition processing (denitrification processing) which does not carry out fixed time amount aeration on an impeller or a pump, and it can process the sanitary sewage to altitude while it can save the power requirement for agitation and mixing (energy saving).

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**TECHNICAL PROBLEM**

---

[Problem(s) to be Solved by the Invention] In the above-mentioned intermittent aeration approach, it is required to agitate the liquid in a tub during the aversion-decomposition processing (denitrification processing) which does not carry out fixed time amount aeration, and it is conventionally based on the impeller or the pump. Pulse aeration performs this invention without depending churning under aversion-decomposition processing (denitrification processing) which is a method of improving the intermittent aeration processing which purifies the sanitary sewage, and does not carry out fixed time amount aeration on an impeller or a pump, carrying out membrane filtration of the active sludge liquid, and the approach of saving the power requirement for agitation and mixing is offered.

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**MEANS**

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[Means for Solving the Problem] This invention is the intermittent aeration art of the following sanitary sewage. (1), supplying the sanitary sewage to the active sludge room in which the powder trachea was prepared under the membrane filtration machine immersed and formed into the liquid with which active sludge piles up, and its membrane filtration machine, and filtering active sludge liquid with a membrane filtration vessel It is the intermittent aeration art of the sanitary sewage which does not carry out aerobic digestion processing which carries out fixed time amount aeration from a powder trachea, and fixed time amount aeration and which repeats both processings of aversion decomposition processing. the loop deer of an aeration halt of the time amount as which said aversion-decomposition processing was determined beforehand, and the pulse aeration following it -- the art of the sanitary sewage characterized by things.

(2) The art of the above (1) which an aeration halt of the time amount defined beforehand is an aeration halt for 5 - 20 minutes, and is what carries out aeration by amount of aeration of 0.05-5.0m<sup>3</sup>/m<sup>3</sup>/min while pulse aeration does not exceed 2 minutes.

[0006] If drawing explains this invention, it comes to be shown in "the time schedule of aeration" (an axis of abscissa is the time amount and an axis of ordinate is the amount of aeration (arbitration unit)) of drawing 1 . Among drawing 1 , T<sub>n</sub> is the time amount of denitrification processing and carries out pulse aeration of the time amount of nitrification processing, and the T<sub>d</sub> by fixed frequency into T<sub>d</sub>.

[0007] In this invention, time amount and frequency (or time amount of an aeration halt) can be synthetically judged from the value of the concentration and the filtration velocity of active sludge liquid in the strength of pulse aeration in the growth rate of the membrane filtration cake at the time of quiescence of active sludge liquid, oxygen transfer rate, and a list, and it can set up. Sludge sedimentation with active sludge liquid with a concentration of about 10,000 ppm remarkable in 5 - 20 minutes is not seen. Moreover, the inflow of the sanitary sewage to the active sludge interior of a room agitates active sludge liquid moderately. Therefore, pulse aeration is good for active sludge liquid at extent to which loose rotating flow happens. although changed with the magnitude of a tub etc., if the magnitude of a tub is one to 3 m<sup>3</sup> -- the amount of aeration of pulse aeration -- 0.05-5.0m<sup>3</sup>/m<sup>3</sup>/min -- it is 0.2-2.0m<sup>3</sup>/m<sup>3</sup>/min preferably, and the time amount of pulse aeration is 30 - 60 seconds preferably less than 2 minutes. If the amount of aeration of pulse aeration is larger than 5.0m<sup>3</sup>/m<sup>3</sup>/min or the time amount of pulse aeration exceeds 2 minutes, maintenance of the anaerobic condition in T<sub>d</sub> will become difficult, and denitrification will tend to become imperfect. Moreover, when the amounts of aeration of pulse aeration are under 0.05m<sup>3</sup>/m<sup>3</sup>/min, it is easy to become the lack of churning of sludge. In addition, m<sup>3</sup> of the unit of the amount of aeration/m<sup>3</sup>/min is the semantics for liquid capacity/in the amount capacity of aeration / tub, for example, when aeration of the air of 3 is carried out per minute 1.0m in the condition that 1.0m of active sludge liquid of 3 exists in the aerator of 3 2.0m, the amount of aeration is 1.0m<sup>3</sup>/m<sup>3</sup>/min. Moreover, the period of the pulse aeration in T<sub>d</sub>, i.e., the die length between one pulse and the following pulse, (time amount) is usually 10 - 15 minutes preferably for 5 to 20 minutes. In less than 5 minutes, maintenance of the anaerobic condition in T<sub>d</sub> becomes difficult, denitrification tends to become imperfect, and if it exceeds 20 minutes, sludge churning for advancing a reaction will tend to become insufficient.

[0008] Although the time amount of 1 cycle of the aerobic digestion processing which carries out fixed time

amount aeration from a powder trachea, and both processings of the aversion-decomposition processing which does not carry out fixed time amount aeration following it (namely,  $T_n+T_d$ ) should just decide on the optimal time amount suitably according to the service condition of a septic tank, it is usually 1 - 4 hours. Moreover, although the time amount ratio of  $T_n$  and  $T_d$  should just also determine the rate of optimum ratio suitably according to the service condition of a septic tank, it is the range of 1:3 to 1:1, and in order to raise the denitrification effectiveness, it usually sets up the  $T_d$  for a long time rather than  $T_n$ .

[0009] When the range of fluctuation of the above setups is taken into consideration, the count of a repetition of "an aeration halt of the time amount defined beforehand and the pulse aeration following it" in  $T_d$  of " $T_n+T_d$ " 1 cycle is usually 2 - 18 times.

[0010] During the aerobic digestion processing which carries out aeration of the active sludge room, ( $T_n$ ) is performed continuously, also works continuously the suction pump which leads to the membrane filtration machine, and filters the aeration from the powder trachea of the active sludge interior of a room. The organic substance in the sanitary sewage oxidizes aerobically by this aeration processing, and a nitride oxidizes even to nitrate ion.

[0011] Active sludge liquid is maintained at an anaerobic condition or a semi- anaerobic condition for ( $T_d$ ) during the aversion-decomposition processing which does not carry out aeration of the active sludge room. Pulse aeration in the meantime is performed in order to aim at churning of reaction mixture.

[0012] The membrane filtration machine immersed and used into active sludge liquid in this invention is a membrane filtration mold solid-liquid-separation machine in which precision filtration is possible, and the membrane filtration machine incorporating a metal filter or a ceramic filter with the membrane filtration machine which consists of a base material which supports an organic poly membrane with precision filtration ability and it, the catchment section, etc., and precision filtration ability etc. can be used for it. Although the various things of plate-like and tubular \*\* can be used for the configuration of a membrane filtration machine, plate-like (flat film module) is used preferably. Since the inside and the outside of a filtration membrane side produce filtration driving force, they attract the filtration membrane inside with a suction pump, or since a water head difference is produced, they install filtrate output port caudad from the oil level of an active sludge room. Moreover, a membrane filtration machine is placed in the direction in which a membrane filtration side becomes perpendicular. It is for eliminating compulsorily the solid deposited on the film surface of a membrane filtration machine according to the liquid upward flow by the aeration from the powder trachea installed under the membrane filtration machine. When using the plate-like film (flat film module), two or more sheets are usually installed.

[0013] In addition, the metal filter in the above rolls out wire gauzes, such as stainless steel, and uses them as a fine mesh substrate. How to apply and sinter the suspension or the paste which contains impalpable powder, such as stainless steel powder, nickel oxide, and copper oxide, in this, The 1st metal powder, such as stainless steel powder, can be made to be able to sinter, the 1st comparatively big filter layer of the diameter of a hole can be made to be able to form, and it can manufacture by the approach of applying and sintering the suspension or the paste which contains impalpable powder, such as stainless steel powder, nickel oxide, and copper oxide, in this etc.

[0014] The powder trachea which is the lower part of a membrane filtration machine, and blows the air from Blois etc. into an active sludge room near the pars basilaris ossis occipitalis of an active sludge room is prepared in an active sludge room. The aeration from this powder trachea also has the duty which eliminates compulsorily the solid deposited on the filtration membrane side of a membrane filtration machine other than the churning purpose of oxygen supply and sludge liquid. With chlorine etc., sterilization processing is carried out and the membrane filtration liquid (founding liquid) which passed the membrane filtration machine is discharged to the last.

[0015]

[Embodiment of the Invention] The intermittent aeration art of the sanitary sewage of this invention is explained based on drawing. The transverse-plane mimetic diagram of the septic tank of an example in which drawing 1 can enforce the time schedule of aeration and drawing 2 can enforce the intermittent aeration art of this

invention, and drawing 3 are the mimetic diagram. The body of a septic tank 1 is usually built in FRP, SMC, etc. In accordance with the flow of the sanitary sewage, a septic tank 1 is large and is divided into the flow control room 2, the active sludge room 3, and the sludge reservoir 4. Moreover, the manhole lid 5 is formed in the septic tank for the facilities at the time of inspection and repair.

[0016] The sanitary sewage flows into the flow control room 2 from the sanitary-sewage inhalant canal 6. Since solids, such as toilet paper, are contained in the sanitary sewage, if it remains as it is, it cannot convey with an air lift pump 10. Then, it once stores in the flow control room 2, and it agitates, carrying out aeration of the air supplied by Blois 14 from the powder trachea 7, and a solid is broken small. The water level of the flow control room 2 has an air lift pump 10 between the lowest water level which cannot pump up the sanitary sewage, and the highest high water level predicted from the amount of maximum flow ON of the sanitary sewage. In the bottom of the lowest water level of the flow control room 2, the reticulated plastics filter bed 8 and the powder trachea 7 are installed, and while always breaking the solid in the sanitary sewage and making it distribute, the solid with difficult crushing of hair and plastics is caught in the reticulated plastics filter bed 8. Thereby, plugging of an air lift pump 10 is prevented and film surface lock out or film breakage of the membrane filtration machine 11 installed in the next active sludge room 3 is prevented.

[0017] The sanitary sewage pumped up with the air lift pump 10 flows into the active sludge room 3. The membrane filtration machine 11 is immersed and arranged in active sludge liquid, and the powder trachea 12 is installed in the active sludge room 3 under the membrane filtration machine 11. The inside of the film surface of the membrane filtration machine 11 leads to the suction pump 16, and active sludge liquid is filtered by the differential pressure produced with the suction pump. The liquid in the active sludge which passed the film (filtrate) is discharged from an effluent pipe 18 as processed water after contacting a sterilizer 17.

[0018] Aeration of the aeration from the powder trachea 12 is intermittently carried out by the aeration schedule as shown by drawing 1, and nitrification processing of the sanitary sewage and both processings of denitrification processing are performed in the active sludge room 3. The control valves 13, such as a solenoid valve and a pressure-controlled valve, are formed in the powder trachea 12, and closing motion of a control valve 13 is controlled by the controlling timer 15 which programmed actuation sequence. And deposition of a sludge cake is prevented according to the upward flow of active sludge liquid according [ the film surface front face of the membrane filtration machine 11 ] to the aeration from the powder trachea 12.

[0019] the pulse aeration for less than 2 minutes which aeration (nitrification processing) of the first fixed time amount is carried out from the powder trachea 12 to the aeration schedule of drawing 1, and follows an aeration halt for after that and 5 - 20 minutes, and it -- multiple times ( drawing 1 4 times) -- it is repeated (denitrification processing). Hereafter, nitrification processing and denitrification processing are repeated according to an aeration schedule. In addition, it keeps [ work / during an aeration halt / a suction pump 16 ] made.

[0020] At the time of periodic maintenance check, after checking the sludge concentration of the active sludge room 3, an air valve 19 is opened, the air lift pump 20 is operated, and sludge (excess sludge) with the difficult decomposition processing in the active sludge room 3 is conveyed in the sludge reservoir room 4. When the oil level of the sludge reservoir room 4 exceeds the overflow opening 21 in that case, the supernatant of the sludge reservoir room 4 overflows to the flow control room 2, is mixed with raw water (sanitary sewage), and is hereafter processed in the same path as raw water.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is a graph showing the time schedule of the aeration in the intermittent aeration art of this invention.

[Drawing 2] It is the transverse-plane mimetic diagram of a septic tank which can enforce the intermittent aeration art of this invention.

[Drawing 3] It is the mimetic diagram of the septic tank of drawing 2 .

### [Description of Notations]

- 1 -- Body of a septic tank
- 2 -- Flow control room
- 3 -- Aerobic active sludge room
- 4 -- Sludge reservoir room
- 5 -- Manhole lid
- 6 -- Inhalant canal
- 7 -- Powder trachea
- 8 -- Reticulated plastics filter bed
- 9 -- Filter bed handle
- 10 -- Air lift pump
- 11 -- Membrane filtration machine
- 12 -- Powder trachea
- 13 -- Control valve
- 14 -- Air blower
- 15 -- Controlling timer
- 16 -- Suction pump
- 17 -- Sterilizer
- 18 -- Effluent pipe
- 19 -- Air valve
- 20 -- Air lift pump
- 21 -- Overflow opening

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[Translation done.]



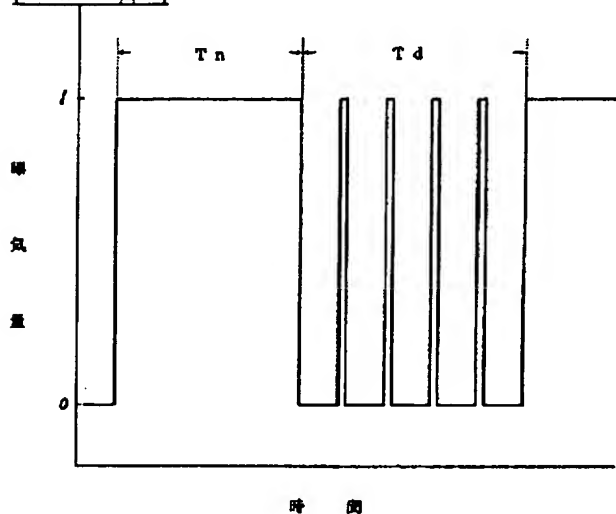
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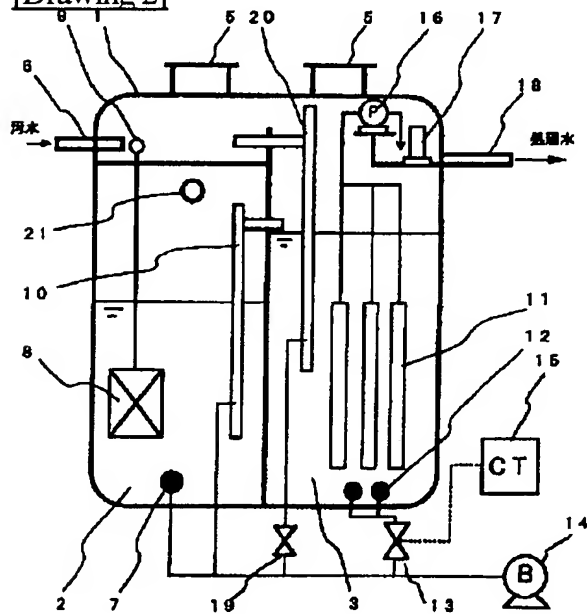
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## DRAWINGS

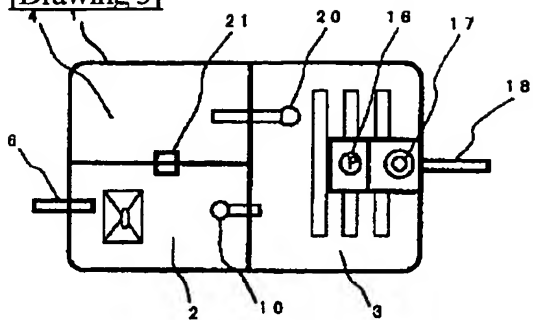
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]